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Comparisons Between Pretest Prediction and Flight Test Data of Aerodynamic Loading for EFT-1

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Abstract Submittal Notes

This submittal to the 23rd AIAA Aviation and Aeronautics Forum and Exposition, to be held in Washington, DC on June 13-17, 2016, represents a body of work completed under the Orion / MPCV Aerosciences Project. This abstract does not contain ITAR restricted data; the final paper will contain ITAR restricted data. The paper will be presented at a special, ITAR restricted session on the Orion EFT-1 Aerosciences.

Abstract

Exploration Flight Test One (EFT-1) was an incredible milestone in the development NASA's Orion spacecraft. It incorporated hundreds of articles of flight test instrumentation and returned with a wealth of data. Aerodynamic surface pressures were collected during launch vehicle ascent and capsule reentry and descent. These discrete surface pressure measurements enable comparisons to computational results and ground test data. This paper details the comparisons between pre-test predictions and flight test data for the Orion MPCV Crew Module (CM) and Launch Abort Tower (LAT) during all phases of flight. Regions with strong comparisons, poor predictions, and lessons learned are discussed.

38 pressure measurements were made on the LAT during ascent. Nine of the gauges were Honeywell PPTs and the remainder were Kulite pressure transducers. In order to address bias in the Kulites, a two-point linear calibration was used and the details are discussed. Results from the flight are compared to existing database products.

44 pressure measurements were made on the CM during reentry and descent. Nine of the gauges were Honeywell PPTs and the remainder were Kulite pressure transducers. In order to address bias in the Kulites, a tare was made against the vacuum measurements as described below. Once the bias was removed from the gauges, comparisons between predicted loading and the measured results are compared.

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